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Treatment Standards for Nonwastewater and Wastewater Forms of K100

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16. Abstract (Limit: 200 words)

This memorandum presents the technical support and rationale for the development of treatment standards for nonwastewater and wastewater forms of K100. Waste code K100 is listed as waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting.

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MEMORANDUM

TO: Monica Chatmon-McEaddy

cc: J. Strauss
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5254 File

FROM: Laura Fargo
Scott Wolff

DATE: November 8, 1989

SUBJECT: Treatment Standards for Nonwastewater and Wastewater Forms of K100

This memorandum presents the technical support and rationale for the development of treatment standards for nonwastewater and wastewater forms of K100.

INTRODUCTION

According to 40 CFR Part 261.32 (hazardous wastes from specific sources), waste code K100 is listed as waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting. Treatment standards for K100 wastes were originally scheduled to be promulgated as part of the Third Third rulemaking. However, a treatment standard of "No Land Disposal Based on No Generation" for K100 nonwastewaters was promulgated on August 8, 1988, and was subsequently revised on May 1, 1989, (54 FR 18836) to be applicable only to "Nonwastewater forms of these wastes generated by the process described in the listing description and disposed after August 17, 1988, and not generated in the course of treating wastewater forms of these wastes [Based on No Generation]."

In the proposal for the Second Third Wastes (54 FR 1056, January 11, 1989), EPA stated its intention to develop concentration-based treatment standards for all forms of K100 prior to May 8, 1990, and has since

decided to propose to revoke the promulgated treatment standard of "No Land Disposal Based on No Generation" for K100 nonwastewaters. EPA prefers to set concentration-based treatment standards in lieu of this standard and is today proposing these for K100 nonwastewaters.

Concentration-based treatment standards for all forms of K100 are proposed today based on the transfer of performance data from other hazardous wastes known to be similar in chemical and physical form to K100 wastes.

INDUSTRY AFFECTED

Based on available information, the Agency believes that this waste is no longer generated by the lead smelting industry. However, K100 treatment standards are still necessary for application to residues from previous disposal.

WASTE CHARACTERIZATION

The Agency has determined that K100 represents a single treatability group based on its expected physical and chemical composition. This group consists of two subgroups -- wastewaters and nonwastewaters. For the purpose of the land disposal restrictions rule, wastewaters are defined as wastes containing less than 1 percent (weight basis) filterable solids and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters.

The Office of Water, Effluent Guidelines Division, Effluent Limitations Guidelines (ELG) reports on the secondary lead smelting industry were reviewed and were found to contain no characterization data on the K100 waste stream. The EPA Preamble on Land Disposal Restrictions for First Third Scheduled Wastes: Final Rule (FR 31138-31222), as well

as the "Response to Comments Related to the First Third Wastes Treatment Technologies and Associated Performance," contain no data on K100 waste and its treatability. The only characterization data available are in a report prepared for the Waste Identification Branch of OSW (USEPA 1985). Table 1 presents these data. It should be noted that these are "synthetic waste" data based on emission control dust composition data and solubility of dust metal constituents in dilute sulfuric acid.

Table 1 K100 - Waste Characterization Data

BDAT constituents	Estimated concentration (mg/l)
Hexavalent chromium	20
Lead	60
Cadmium	110

Source: USEPA 1985.

APPLICABLE AND DEMONSTRATED TECHNOLOGIES

This section describes the applicable treatment technologies for the treatment of K100 waste. The Agency identified the applicable treatment technologies based on the estimated waste composition (see Table 1). The technologies considered to be applicable are those designed to reduce the concentration of BDAT list metals present in the treated residual and/or reduce the leachability of BDAT list metals in the treated residual.

Chemical precipitation followed by dewatering of the precipitated solids is an applicable technology for the removal of the dissolved metals from K100 wastewater. Ordinarily, ion exchange would be an applicable

technology. However, K100 is likely to have a very high ionic strength since it is derived from acid leaching. Ion exchange is not conducive to solutions with very high ionic strengths. Additionally, the presence of hexavalent chromium indicates the need for chromium reduction to convert hexavalent chromium to trivalent chromium prior to precipitation.

Dewatering of the precipitated solids results in a nonwastewater filter cake stream and a wastewater filtrate stream. The filtrate may be further processed by polishing filtration, such as multimedia filtration, to remove the remaining suspended solids. For the nonwastewater solids that are precipitated and filtered, stabilization may be used to reduce the leachability of the BDAT list metals.

All of the applicable technologies are demonstrated. Hexavalent chromium reduction, chemical precipitation, and dewatering by settling and/or filtration are widely practiced as a metals treatment technology for aqueous wastes. In addition, polishing filtration is a well-documented technology for removing insoluble material from wastewater streams. Regarding treatment of the precipitated solids, stabilization of wastewater treatment sludges is well demonstrated.

PERFORMANCE DATA BASE

Lacking specific data on treatability of K100 wastes, EPA is considering concentration-based treatment standards for wastewater forms of K100 based on the transfer of performance data for metals precipitation from K062 wastewaters, and data for metals stabilization from F006 and K061 nonwastewaters.

A. Wastewaters. The Agency has 11 data sets for treatment of metal bearing wastewaters containing hexavalent chromium, lead, and cadmium by the treatment methods of hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate. These data are

presented in Tables 2 through 12. These metal bearing wastewaters include waste code K062, as well as other metal containing waste streams, and these data were previously used in the development of treatment standards for K062 in the First Third Final Rule (USEPA 1988b). The Agency believes that these K062 data can be used to assess the performance of these technologies for K100 wastewaters, since the untreated K062 wastewaters contain much higher metals concentrations than K100 wastewaters are expected to contain.

B. **Nonwastewaters**. Treatment performance data are not available for K100 nonwastewaters specifically. However, performance data are available from stabilization tests on F006 and K061 nonwastewaters using various pozzolonic binders in various mix ratios. The data presented in Table 13 represent performance data developed from stabilization of F006 waste, while the data in Table 14 represent treatment of K061 wastes. These data were previously used in the development of treatment standards for F006 and K061 in the First Third Final Rule (USEPA a,c).

Table 2 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #1

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 805	Treated waste (wastewater) (mg/l) Sample No. 806
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	13	<0.5
Chromium (hexavalent)	I	I	893	0.011
Chromium (total)	1600	7000	2581	0.12
Copper	865	306	138	0.21
Lead	<10	<10	64	<0.01
Nickel	3200	2600	471	0.33
Zinc	<2	<2	116	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 3 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #2

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreted waste composite[a] (mg/l) Sample No. 813	Treated waste (wastewater) (mg/l) Sample No. 814
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	807	0.12
Chromium (total)	1800	7000	2270	0.19
Copper	885	306	133	0.15
Lead	<10	<10	54	<0.01
Nickel	3200	2600	470	0.33
Zinc	<2	<2	4	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 4 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #3

Constituent	Untreated K062 waste (mg/l) Sample No. 817	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 821	Treated waste (wastewater) (mg/l) Sample No. 822
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	5	<0.5
Chromium (hexavalent)	I	I	775	I
Chromium (total)	1700	7000	1990	0.20
Copper	425	306	133	0.21
Lead	<10	<10	<10	<0.01
Nickel	100310	2600	16330	0.33
Zinc	7	<2	3.9	0.140

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1985b.

Table 5 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #4

Constituent	Untreated K062 waste (mg/l) Sample No. 827	Untreated K062 waste (mg/l) Sample No. 802	Untreated K062 waste (mg/l) Sample No. 817	Untreated waste composite[a] (mg/l) Sample No. 829	Treated waste (wastewater) (mg/l) Sample No. 830
Arsenic	2	<1	3	<1	<1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	1	I	I	0.6	0.042
Chromium (total)	142	7000	1700	556	0.10
Copper	42	306	425	88	0.07
Lead	<10	<10	<10	<10	<0.01
Nickel	650	2600	41000	6610	0.33
Zinc	3	<2	7	84	1.62

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 6 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #5

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated K062 waste (mg/l) Sample No. 817	Untreated waste composite[a] (mg/l) Sample No. 837	Treated waste (wastewater) (mg/l) Sample No. 838
Arsenic	3	<1	3	<1	<0.1
Cadmium	<5	<5	5	<5	<0.5
Chromium (hexavalent)	I	I	I	917	0.058
Chromium (total)	1800	7000	1700	2236	0.11
Copper	865	306	425	91	0.14
Lead	<10	<10	<10	18	0.01
Nickel	3200	2600	41000	1414	0.31
Zinc	<2	<2	7	71	0.125

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

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Table 7 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #6

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 845	Treated waste (wastewater) (mg/l) Sample No. 846
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	I	I	734	I
Chromium (total)	1800	7000	2548	0.10
Copper	865	306	149	0.12
Lead	<10	<10	<10	<0.01
Nickel	3200	2600	588	0.33
Zinc	<2	<2	4	0.095

Design and Operating Data

	Design value	Operating value
pH	8-10	8

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 8 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #7

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 853	Treated waste (wastewater) (mg/l) Sample No. 854
Arsenic	3	<1	<1	<0.1
Cadmium	<5	<5	10	<0.5
Chromium (hexavalent)	I	I	769	0.12
Chromium (total)	1800	7000	2314	0.12
Copper	865	306	72	0.16
Lead	<10	<10	108	<0.01
Nickel	3200	2600	425	0.40
Zinc	<2	<2	171	0.115

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 9 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #6

Constituent	Untreated K062 waste (mg/l) Sample No. 859	Untreated K062 waste (mg/l) Sample No. 801	Untreated waste composite[a] (mg/l) Sample No. 861	Treated waste (wastewater) (mg/l) Sample No. 862
Arsenic	<1	3	<1	<0.1
Cadmium	<5	<5	<5	<0.5
Chromium (hexavalent)	0.220	I	0.13	<0.01
Chromium (total)	15	1800	831	0.15
Copper	151	865	217	0.16
Lead	<10	<10	212	<0.01
Nickel	90	3200	669	0.36
Zinc	7	9	151	0.13

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 10 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #9

Constituent	Untreated K062 waste (mg/l) Sample No. 867	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 802	Untreated waste composite[a] (mg/l) Sample No. 869	Treated waste (wastewater) (mg/l) Sample No. 870
Arsenic	<0.1	3	<1	<1	<0.1
Cadmium	<0.5	<5	<5	<5	<0.5
Chromium (hexavalent)	0.079	I	I	0.07	0.041
Chromium (total)	6	1800	7000	939	0.10
Copper	5	865	306	225	0.08
Lead	<1	<10	<10	<10	<0.01
Nickel	4	3200	2600	940	0.33
Zinc	0.4	<2	<2	5	0.06

Design and Operating Data

	Design value	Operating value
pH	8-10	10

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 11 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #10

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated waste composite[a] (mg/l) Sample No. 885	Treated waste (wastewater) (mg/l) Sample No. 862
Arsenic	<3	<1	<0.10
Cadmium	<5	<5	<0.5
Chromium (hexavalent)	I	0.08	0.106
Chromium (total)	1800	395	0.12
Copper	885	191	0.14
Lead	<10	<10	<0.01
Nickel	3200	712	0.33
Zinc	<2	5	0.070

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1988b.

Table 12 Treatment Performance Data for K062 - EPA-Collected Data

Sample Set #11

Constituent	Untreated K062 waste (mg/l) Sample No. 801	Untreated K062 waste (mg/l) Sample No. 859	Untreated waste composite[a] (mg/l) Sample No. 893	Treated waste (wastewater) (mg/l) Sample No. 894
Arsenic	3	<1	<1	<0.10
Cadmium	<5	<5	23	<5
Chromium (hexavalent)	I	0.220	0.30	<0.01
Chromium (total)	1800	15	617	0.18
Copper	865	151	137	0.24
Lead	<10	<10	136	<0.01
Nickel	3200	90	382	0.39
Zinc	<2	7	135	0.100

Design and Operating Data

	Design value	Operating value
pH	8-10	9

I = Color interference.

[a] The untreated waste composite is a mixture of the untreated K062 waste streams shown on this table, along with other non-K062 waste streams.

Source: USEPA 1986b.

Table 13 Treatment Performance Data for Stabilization of F006 Nonwastewater[a]

Source	Mix ratio[b]	Metal concentrations (ppm)							
		Barium	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc
Unknown									
Unstabilized									
As received	-	-	-	-	-	-	435	-	1560
TCLP	-	-	-	-	-	-	0.71	-	0.16
Stabilized									
TCLP	0.2	-	-	-	-	-	0.05	-	0.03
Auto part manufacturing									
Unstabilized									
As received	-	-	31.3	755	7030	409	989	6.62	4020
TCLP	-	-	2.21	0.76	638	10.7	22.7	0.14	219
Stabilized									
TCLP	0.5	-	0.01	0.45	0.27	0.39	0.03	0.06	0.01
Aircraft overhauling									
Unstabilized									
As received	-	85.5	67.3	716	-	-	259	-	631
TCLP	-	1.41	1.13	0.43	-	-	1.1	-	5.41
Stabilized									
TCLP	0.2	0.34	0.06	0.09	-	-	0.27	-	0.03
Zinc plating									
Unstabilized									
As received	-	17.2	1.30	-	1510	-	37	9.05	90,200
TCLP	-	0.84	0.22	-	4.6	-	0.52	0.16	2050
Stabilized									
TCLP	0.5	0.25	0.01	-	0.21	-	0.02	0.05	0.04
Unknown									
Unstabilized									
As received	-	14.3	720	12,200	160	-	701	-	25,900
TCLP	-	0.38	23.6	25.3	1.14	-	9.78	-	867
Stabilized									
TCLP	0.5	0.21	0.01	0.44	0.31	-	0.04	-	0.03

Table 13 (continued)

Source	Mix ratio[a]	Metal concentrations (ppm)							
		Barium	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc
Small engine manufacturing									
Unstabilized									
As received	-	-	7.28	3100	1220	113	19,400	4.08	27,800
TCLP	-	-	0.3	38.7	31.7	3.37	730	0.12	1200
Stabilized									
TCLP	0.5	-	0.01	0.89	0.31	0.39	0.06	0.06	0.040
Circuit board manufacturing									
Unstabilized									
As received	-	-	5.39	42,900	10,600	156	13,000	-	120
TCLP	-	-	0.60	360	8.69	1.0	152	-	0.62
Stabilized									
TCLP	0.5	-	0.01	1.41	0.45	0.41	0.11	-	0.020
Unknown									
Unstabilized									
As received	-	15.3	5.81	-	17,600	169	23,700	8.11	15,700
TCLP	-	0.53	0.18	-	483	4.22	644	0.31	650
Stabilized									
TCLP	0.5	0.294	0.01	-	0.35	0.40	0.04	0.06	0.020
Unknown									
Unstabilized									
As received	-	19.2	-	-	27,400	24,500	5,730	-	322
TCLP	-	0.28	-	-	16.9	50.2	16.1	-	1.29
Stabilized									
TCLP	0.5	0.087	-	-	0.50	0.29	<0.02	-	<0.01

[a]Adjusted analytical results (referred to as accuracy-corrected concentrations) used for comparing the performance of one technology to that of another and for calculating treatment standards for those constituents to be regulated (USEPA 1988a).

[b] Mix ratio = $\frac{\text{weight of reagent}}{\text{weight of waste}}$

Source: USEPA 1988a.

Table 14 Summary of Treatment Performance Data for Stabilization of K061 Nonwastewater Using a Lime/Flyash Binder (EPA Collected Data)

Constituents	Untreated waste Total (ppm)	Untreated waste TCLP (mg/l)	Treated waste TCLP (mg/l)
Antimony	294	0.040	<0.050
Arsenic	36	<0.010	<0.010
Barium	238	0.733	0.431 - 0.500
Beryllium	0.15	<0.001	<0.001
Cadmium	481	12.8	0.033 - 0.073
Chromium	1,370	<0.007	0.053 - 0.093
Copper	2,240	0.066	<0.004 - 0.015
Lead	20,300	45.1	0.066 - 0.150
Mercury	3.8	0.0026	0.0016 - 0.0018
Nickel	243	0.027	<0.012
Selenium	<5.0	<0.050	<0.025
Silver	59	0.021	<0.003
Thallium	<1.0	0.038	0.011 - 0.014
Vanadium	25	<0.006	0.080 - 0.089
Zinc	244,000	445	0.179 - 0.592
Oil and grease	282		
Sulfates	8,440		
Chlorides	19,300		
TOC	4,430		

Source: USEPA 1988c.

IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the rationale for the determination of best demonstrated available technology (BDAT) for nonwastewater and wastewater forms of K100. The Agency examined all the available treatment performance data for the demonstrated technologies to determine which is best. Treatment performance data are available for metal bearing wastewaters containing K062 waste that is believed to be similar to K100 wastewaters. For K100 nonwastewaters, performance data are available from stabilization tests on F006 and K061 nonwastewaters.

A. Wastewater. Available treatment performance data presented in Tables 2-12 for treatment of K062 wastewaters by chromium reduction, chemical precipitation, and filtration show that this treatment is effective. Total chromium was reduced from 2,581 mg/l to 0.12 mg/l; cadmium from 13 mg/l to <0.5 mg/l; nickel from 471 mg/l to 0.33; and lead from 64 mg/l to <0.01 mg/l. The Agency has determined that the data collected from treatment of K062 wastewaters represents a well-designed and well-operated system and therefore may be used to compare treatment performance of demonstrated technologies.

Based on the evaluation of the available treatment performance data and other information, the Agency believes that the treatment train consisting of hexavalent chromium reduction, chemical precipitation, and settling and/or filtration represents BDAT for K100 wastewaters.

B. Nonwastewaters. EPA compared the F006 wastes and K061 wastes with regard to metals concentrations. In general, both K061 nonwastewaters and F006 nonwastewaters contain similar metal constituents but F006 has several BDAT list metals at higher concentrations. Specifically, chromium is present in the untreated F006 wastes at concentrations as high as 42,900 ppm and in K061 wastes as high as 1,370 ppm; lead is

present in F006 in concentrations as high as 24,500 ppm and in K061 wastes at 20,300 ppm; and cadmium is present in F006 wastes at concentrations as high as 720 ppm and in K061 wastes as high as 481 ppm. Additional characterization of the wastes (USEPA 1988a,c) show that F006 wastes have higher concentrations of organics than K061, which would tend to make the F006 waste more difficult to treat by stabilization techniques based on waste characteristics that affect the stabilization process. Importantly, K100 nonwastewaters would be formed by chemical precipitation processes similar to the processes that form F006 nonwastewaters. K061 nonwastewaters generally do not result from chemical precipitation. Therefore, K100 nonwastewaters are expected to be more similar to F006 than K061

Although no waste characterization data for K100 nonwastewaters are available, based on the above reasons, the Agency believes that the treatment levels achieved for cadmium, lead, and chromium in the F006 wastes can also be achieved for K100. Accordingly, EPA is using F006 performance data to establish treatment standards for K100 nonwastewaters.

The performance data that EPA used in assessing substantial treatment are shown in Table 13. As shown, stabilization achieved substantial reductions in the leachate value for all of the metals selected for regulation. (The next Section presents a discussion of constituents selected for regulation.) Specifically, TCLP leachate concentrations in the treated waste were no more than 0.06 mg/l for cadmium, 1.41 mg/l for chromium, and 0.41 mg/l for lead.

The Agency believes the reduction in the range and magnitude of the various hazardous constituents to be substantial. Stabilization has been determined to be demonstrated and best, has provided substantial treatment, and is commercially available; therefore, stabilization represents BDAT for K100 nonwastewaters.

Selection of Regulated Constituents

The previous section explained the Agency's selection of the best demonstrated and available treatment technology for treating K100 wastes. The constituents chosen by the Agency for regulation are those expected to be found in untreated wastes at treatable concentrations for the selected BDAT. The metals expected to be found in treatable concentrations in the untreated K100 waste are chromium, lead, and cadmium (based on Table 1 data). Each of these three metals is chosen for regulation in K100 wastes.

Development of Treatment Standards

This section presents the treatment standards for the regulated constituents described previously. A description of the rationale and procedures for calculating treatment standards for wastewaters is presented in the K062 background document (1988b). For nonwastewaters, the rationale for the chosen standards is presented in the F006 background document (1988a). The BDAT treatment standards presented in this section (1) are reflective of treatment performance data from a well-designed and well-operated treatment system, (2) are adjusted for analytical accuracy, and (3) have been adjusted for variability caused by treatment, sampling, and analytical techniques and procedures.

A. Wastewaters. EPA compared the K062 wastewaters and K100 waste stream shown in Table 1 with regard to concentrations of metals. In general, both K100 wastewaters and K062 wastewaters contain similar metal constituents. As noted earlier though, K062 wastewaters have BDAT list metals at higher concentrations than do K100 wastewaters. Therefore, EPA would expect the K062 wastewaters to be more difficult to treat effectively by the treatment system consisting of hexavalent chromium reduction, chemical precipitation, settling, and/or filtration.

Further, based on the available data relative to waste characteristics, the Agency has no reason to believe that the treatment levels achieved for K062 wastewaters cannot be achieved for K100 wastewaters. Accordingly, EPA is using the K062 wastewater performance data for hexavalent chromium reduction, chemical precipitation, and settling and/or filtration to establish treatment standards for K100 wastewaters. Therefore, the Agency is transferring the treatment performance data from the treatment train for K062 wastewaters to K100 wastewaters.

The 11 data sets for treatment of K062 wastewaters by hexavalent chromium reduction, chemical precipitation, and dewatering of the precipitate were determined to represent treatment by a well-designed and well-operated treatment system (USEPA 1988b). One treatment data set for cadmium was rejected (Sample Set #11) because of an artificially high detection limit of 5 mg/l, which deviated from the other 10 data points' detection limits of 0.5 mg/l.

The remaining analytical data sets for this treatment system were corrected for analytical recovery by multiplying the data by their respective correction factors. An arithmetic average of concentration levels for each regulated constituent and a variability factor for each regulated constituent were then calculated. The treatment standard for each regulated constituent was calculated by multiplying the average accuracy corrected data by the appropriate variability factor. An expanded description of the calculation of these treatment standards is presented in the K062 background document (USEPA 1988b).

Table 15 shows the calculations for the three metals regulated for K100 wastewaters. For the RDAT list metal constituents, treatment standards in the wastewater reflect the total constituent concentration. The units for the total constituent concentration are mg/l (parts per

Table 15 Calculation of the Treatment Standards for the Regulated Constituents - Treated Wastewater

Regulated constituent (correction factor)	Average corrected concentration (mg/l)	Number of samples	Average	Variability factor	Treatment standard (mg/l)
Cadmium (1.15)	<0.575	10	0.575	2.8[a]	1.61
	<0.575				
	<0.575				
	<0.575				
	<0.575				
	<0.575				
	<0.575				
	<0.575				
	<0.575				
Chromium (total) (1.47)	0.1765	11	.1898	1.69	0.32
	0.1765				
	0.2941				
	0.1471				
	0.1618				
	0.1471				
	0.1765				
	0.2206				
	0.1471				
	0.1765				
	0.2647				
Lead (1.316)	<0.0132	11	0.0132	2.8[a]	0.04
	<0.0132				
	<0.0132				
	<0.0132				
	0.0132				
	<0.0132				
	<0.0132				
	<0.0132				
	<0.0132				
	<0.0132				
	<0.0132				

[a]For cases in which all values are at or below the detection limit, the variability factor is taken as 2.8.

million on a weight-by-volume basis) for the wastewater. If the concentrations of the regulated constituents in the K100, as generated, are lower than or equal to the concentration limits established in BDAT treatment standards, then treatment is not necessary as a prerequisite to land disposal.

B. **Nonwastewaters**. Specifically, EPA believes that the data on stabilization of F006 waste can be used to assess treatment performance for chromium, cadmium, and lead in K100 nonwastewaters.

The data presented for stabilization of F006 nonwastewaters (see Table 13) has been evaluated by EPA to ensure that any data representing poor design and poor operation were deleted and that all data were adjusted for analytical accuracy. Using the accuracy corrected data, EPA developed treatment standards by averaging the performance data for each constituent and then multiplying the average value by a variability factor that accounts for variations in technology performance, waste characteristics, and laboratory analysis. An expanded description of the calculation of these treatment standards is presented in the K062 background document.

Table 16 shows the calculations for the three metals regulated for K100 nonwastewaters. For the BDAT list metal constituents, treatment standards in nonwastewater reflect the concentration of constituents in the leachate from the Toxicity Characteristic Leaching Procedure (TCLP). The units for the leachate concentration are mg/l (parts per million on a weight-by-volume basis). If the concentrations of the regulated constituents in K100 TCLP leachate, as generated, are lower than or equal to the limits set by the BDAT treatment standards, then treatment is not necessary as a prerequisite to land disposal.

Table 16 Calculation of the Treatment Standards for the Regulated Constituents -- Treated Nonwastewater

	Cadmium	Chromium	Lead
Concentration (mg/l)	0.01 0.06 0.01 0.01 0.01 0.01 0.01	0.45 0.09 0.44 0.89 1.41	0.39 0.39 0.41 0.40 0.29
Average	0.018	0.66	0.37
Number of samples	7	5	5
Variability factor	3.72	7.94	1.37
Treatment standard (mg/l)	0.066	5.2	0.51

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